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From the Editors

Much has been written in the recent past about volunteering. It is a part of life for a large proportion of the population, and something that has benefits for and impacts on almost every member of society. Australian Bureau of Statistics figures show that 34% of adult men and 38% of women spend some part of their week in voluntary labour.

For the FNCV, such freely-given time has always been the essential element in maintaining our existence. In this, the Club is typical; recent surveys indicate that 37% of the voluntary work in Victoria is done in recreational organisations. The Club's activities are a good example of the enormous amount of time and effort (and dedication on the part of its members) that goes into the day-to-day operation of the organisation. The publishing of *The Victorian Naturalist* is a case in point.

Over the greater part of its 133-year history this journal has been produced by individuals who worked as the sole editor and performed all of the pre-printing tasks themselves. In the past 35 years or more, the content of the journal has demanded a more detailed and time-consuming process, one which requires input from a range of people. Today, *The Victorian Naturalist* is an internationally recognised journal, which carries refereed reports of research and contributions in scientific fields.

The process that generates the journal is necessarily elaborate, and rests very firmly on the shoulders of people—many outside the Club—who voluntarily referee, proofread, and correct the text. The role of the editors is now well beyond the capability, not to say the time, of a single individual. But, even with an editorial team of four, the editorial process takes time to produce an issue. We are dependent on the referees and proofreaders, who give their time freely and can not, nor should not, be pinned down to a firm timetable.

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Front cover: Sweeping bend of the Murray River near Mildura. Photo by Anne Morton.
Back cover: Flooded River Red Gum forest. Photo by Lindy Lumsden.

Feeding ecology of the Green Catbird *Ailuroedus crassirostris* in the Illawarra region, New South Wales

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Abstract
Feeding ecology in the Green Catbird *Ailuroedus crassirostris*, a primary frugivore of temperate and subtropical rainforests of eastern Australia, was investigated in the Illawarra rainforests over a five-year period. Fruit from 20 species of trees, shrubs and climbers was identified in the diet, which comprised 25% of available fruiting species in the region. Bolwarra *Eupomatia laurina*, Brown Beech *Pennantia cunninghamii* and Featherwood *Polyosma cunninghamii* were the most important feed species. Sandpaper Fig *Ficus coronata* was moderately exploited, although figs were not as important in the local diet as they were in the northern part of the species' range. Seven fruiting plants were new additions to the known diet, as were sections of Lantana *Lantana camara* stems. Knowledge of Green Catbird diet at regional scales improves the assessment of suitable habitat and assists rainforest restoration by identifying priority plant species that benefit catbirds. (*The Victorian Naturalist* 133 (1), 2016, 4–9)

Keywords: bowerbirds, diet, foraging, frugivore, rainforest restoration

Introduction

Frugivores play a keystone role in forest ecosystems as agents of seed dispersal, and aid the reproductive cycles of up to 80 % of subtropical rainforest flora (Snow 1962; Smythe 1970; Leck 1971; Webb and Tracey 1981). At least 26 bird species in eastern Australia are considered primarily frugivorous (Holmes 1987; Green 1993). Fluctuating abundance of fruit resources have an important influence on their ecology, e.g. nomadism and timing of breeding events (Snow and Snow 1964; Crome 1975, 1976). A single fruiting tree may be exploited by a variety of species (French *et al.* 1992; Neilan *et al.* 2006), therefore dietary overlap amongst frugivores is expected to be high (Terborgh and Diamond 1970).

The Green Catbird *Ailuroedus crassirostris* is found along the entire length of the east coast of New South Wales (NSW) and south-eastern Queensland where there is suitable habitat, not extending far beyond the inland slopes of the Great Dividing Range. It inhabits temperate and subtropical rainforests and adjacent eucalypt forests from near sea level to over 1000 m ASL. The Green Catbird is considered a generalist omnivore, primarily frugivorous or herbivorous (Frith and Frith 2004). More than 75 % of the diet consists of fruits (Donaghey 1981). Other components include flowers, palm seeds, leaves and invertebrates such as beetles and their larvae, millipedes, cicadas and grasshoppers (Lea and Gray 1936; Gwynne 1937; Donaghey 1981; Chaffer 1984; Frith and Frith 1979, 2004). There are also records of predation on nestling birds (Bell 1960; Donaghey 1981), frogs (Innis and McEvoy 1992) and lizards (Lemckert *et al.* 2007). Captive catbirds also are known to feed on dead mice placed in an aviary for another species (Bell 1960).

The feeding ecology of the Green Catbird has been investigated only in the northern parts of its distribution (Donaghey 1981; Innis and McEvoy 1992; Church 1997). One study in the Jimna and Conondale Ranges, south-eastern Queensland, recorded fruits from more than 100 plant species in the diet at lowland and upland sites (Innis and McEvoy 1992). Less diverse flora would be expected for rainforest areas located further south (Floyd 1982; Keith 2004). It is therefore important to understand the feeding ecology of the Green Catbird in the southern part of its distribution.

Rainforests in the Illawarra region have been identified as an important stronghold for the Green Catbird in the southern part of its range (NSW NPWS 2011; Schulz and Magarey 2012)

but are severely fragmented (Stork *et al.* 2008). This paper reports on a five-year study of Green Catbird feeding ecology, carried out simultaneously with a broader project on fruiting phenology and avian frugivory (Waterhouse 1995; Waterhouse 2001; Mo and Waterhouse 2015). Here we sought to determine the diet of the Green Catbird in the Illawarra rainforests, particularly in comparison with that recorded in northern locations (Donaghey 1981; Innis and McEvoy 1992; Church 1997). In view of reduced flora diversity, it was hypothesised that the diet in the Illawarra rainforests would contain fewer species. Information on diet and feeding techniques provide a basis for assessing optimal habitat areas for catbirds and identifying plant species most suitable for restoring rainforest linkages.

Methods

Study area

The Illawarra region contains the most extensive rainforest area in the Sydney Basin Bioregion (Erskine 1984; NSW NPWS 2002), and one of six major rainforest regions in NSW (Floyd 1982). Generally, subtropical rainforest occurs on the lower slopes of the escarpment, and temperate rainforest on the upper slopes and gullies. Canopy height ranges from 35 to 50 m. Two sections of the Illawarra Escarpment State Conservation Area formed the main study sites: Mount Keira (34° 24' S, 150° 51' E, ~600 ha area) and Bulli Mountain (34° 20' S, 150° 54' E, ~100 ha area). Four additional sites were visited sporadically: Bola Creek in the Royal National Park (34° 9' S, 151° 1' E, ~100 ha area), Minnamurra Falls in Budderoo National Park (34° 38' S, 150° 43' E, ~90 ha area), Foxground (34° 43' S, 150° 46' E, ~60 ha area) and Saddleback Mountain (34° 41' S, 150° 47' E, ~70 ha area).

From 1988 to 1992, mean annual rainfall in the study area was 1726 mm (Australian Bureau of Meteorology, Wollongong University station, 1988–1992). The most rainfall was recorded for the months of February, April and June. Mean daily temperatures ranged from 8°C (August) to 25°C (January).

Data collection

The main study sites, Mount Keira and Bulli Mountain, were subject to one-day visits on a fortnightly basis between January 1988 and December 1992, giving a total of 132 field days. Mount Keira was surveyed from Robertson's Lookout, Byarong Park, the Mount Keira Ring Track (~5.5 km) and the Dave Walsh's Track (~800 m). Bulli Mountain was surveyed from Bulli Lookout and a walking track that extends to Sublime Point (~2.5 km). The additional sites were visited up to four times per year.

Green Catbirds were located by traversing walking tracks, with particular attention given to listening for calls. When catbirds were sighted, details of their behaviour and food sources were noted. One feeding record is defined as each fruit species consumed by a single catbird for the duration that it was followed. Trees, shrubs and vines that were in fruit were noted so as to determine food availability and to develop a monthly fruiting phenology for the study period. Core fruiting periods for each species were determined as the period of months in which crop production occurred in at least 60 % of years.

Results

Catbirds were difficult to locate and surveys yielded only 77 observations. Most of these observations were made at Mount Keira (n=55) and Bulli Mountain (n=13). Surveys of Bola Creek yielded six observations and surveys of Minnamurra Falls, Foxground and Saddleback Mountain yielded one observation each. The highest rates of encounter occurred in January, September and October (Table 1). Feeding observations were made in all months of the year, but these were scant in at least half the months. When catbirds were disturbed, they often ceased feeding and retired to a lookout position until the observer passed.

Fruit component of the diet

This study identified 80 species of trees, shrubs and climbers that produce fleshy fruit (see Mo and Waterhouse 2015), a quarter of which were included in the Green Catbird diet (Table 2). More than 95 % of fruits consumed were recorded within 42 months of the 60-month study period, indicating that the sampling regime was adequate. Fruiting reliability of 100% was observed only in three species in the diet. There was little difference in the number of

Table 1. Total number of observations of Green Catbirds *Ailuroedus crassirostris* for each month between 1988 and 1992, including the number of feeding observations in the Illawarra region, NSW.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total no. observations	10	4	3	2	2	8	4	8	13	10	9	4
No. feeding observations	8	2	3	2	2	5	3	8	8	8	5	2

Table 2. Fruiting reliability of plants consumed by the Green Catbird *Ailuroedus crassirostris* in the Illawarra rainforests, NSW. Integers indicate the percentage of years fruiting occurred in each month, January to December. Bold and italicised integers indicate those months in which feeding by catbirds was observed.

	Month											
Species	J	F	M	A	M	J	J	A	S	O	N	D
Red Ash *Alphitonia excelsa*										***20***		
Staff Vine *Celastrus subspicata*			60	***60***	40	60	20					
Kangaroo Vine *Cissus antarctica*					20	20	100	80	***60***	20	20	
Water Vine *Cissus hypoglauca*			40	60	***80***	***60***	20	40	20			
Giant Stinging Tree *Dendrocnide excelsa*					***40***	60		20				
Black Plum *Diospyros australis*			20	40	40	80	***40***	40	***20***			
Native Tamarind *Diploglottis australis*	***40***											20
White Quandong *Elaeocarpus kirtonii*	20	20									20	20
Bolwarra *Eupomatia laurina*				40	20	***100***	***60***	***40***	40	20		
Sandpaper Fig *Ficus coronata*	20	***60***	***80***	60					20			
Moreton Bay Fig *Ficus macrophylla*	60	80	***60***	20	20	20						40
Small-leaved Fig *Ficus oblique*	40	20						20	40	***20***		
Brown Beech *Pennantia cunninghamii*	20	20							***20***	***20***	***80***	***80***
Pepper Vine *Piper novaehollandiae*	***80***	20										20
Featherwood *Polyosma cunninghamii*			20	***60***	40	***80***	60	***60***	***60***			20
Brush Muttonwood *Myrsine howittiana*	***20***									***20***	***40***	20
Scrub Turpentine *Rhodamnia rubescens*	***20***											
Crabapple *Schizomeria ovata*	***20***	100	100	40	20							
Lillypilly *Syzygium smithii*						40	***80***	***60***	20			
Tree Heath *Trochocarpa laurina*							20			***20***		

fruiting plants in the diet available between seasons (10–11 species per season). Diet diversity was broader in spring and summer (11 and eight species consumed respectively) than in autumn and winter (six and five species consumed respectively); however, feeding observations in the cooler months were fewer.

The most important feed trees were Bolwarra *Eupomatia laurina*, Brown Beech *Pennantia cunninghamii* and Featherwood *Polyosma cunninghamii*, contributing almost 40% of feeding records. Bolwarra fruited from mid-autumn to mid-spring, with a core fruiting period between June and July (60–100% reliability). Featherwood had an extensive fruiting period, mostly reliable in April (60%), June (80%) and from August to September (60%). Brown Beech fruited from September to February, with a core fruiting period between November and December (80% reliability). The Sandpaper Fig *Ficus coronata*, which fruited reliably from February to April (60–80%), was also used moderately (5% of all feeding observations).

In most months, two to four plant species in the diet produced fruit reliably. Reliable fruiting occurred in at least one species in all months, except October. At this time of the year, catbirds were seen pecking off portions of stem from Lantana *Lantana camara*. In four observations, catbirds fed on unripe fruits from Brush Muttonwood *Myrsine howittiana*, Red Ash *Alphitonia excelsa*, Moreton Bay Fig *Ficus macrophylla* and White Quandong *Elaeocarpus kirtonii*. In each case, ripe fruits from other species were available at the time.

Feeding techniques

In most observations, catbirds fed singly (61%) or in pairs (29%). Feeding groups of three and four were seen four and two times respectively. Feeding occurred mostly in the upper and mid-canopy (93% of observations), with only three observations of catbirds recovering fallen Crabapple *Schizomeria ovata*, White Quandong and Lillypilly *Syzygium smithii* fruits on the ground. One catbird also chased a cicada through the canopy in January 1988 and an adult fed a fledgling by turning over leaf litter for insects and millipedes in February 1989.

Fruits were gleaned by various means; catbirds commonly perched next to the clusters and gleaned sideways. For Lillypilly and Featherwood, catbirds were often positioned below clusters and sprang up to pluck one at a time. Featherwood fruits also were dislodged from branches by catbirds hovering mid-air, one managing to dislodge fruit in a continuous flight. For Bolwarra and Brown Beech, catbirds sometimes hung upside down to glean. Typically, Brown Beech fruits from a single tree were exhausted by a catbird before it moved on.

Some fruits were swallowed whole, e.g. Lillypilly and Brown Beech. At times, feeding was rapid, with up to 12 Lillypilly fruits consumed within periods of six minutes. Fruits also were squashed in the bill before swallowing, or eaten in portions while still attached to the tree. The flesh of Bolwarra fruits came away in sticky strips with seeds adhering. Catbirds were restless when feeding, often changing perches after only a short time. Those feeding on Brush Muttonwood consumed three to four berries from one cluster before changing positions. Catbirds consumed fruits close to where they gleaned, except on two occasions in which clusters of fruits from Featherwood and Giant Stinging Tree *Dendrocnide excelsa* were carried in flight. Both of these observations were made outside the breeding season.

Foraging associations with other frugivores was recorded in 16% of feeding observations, occurring throughout the year. Green Catbirds associated mostly with Satin Bowerbirds *Ptilonorhynchus violaceus*, feeding together on Sandpaper Fig, Brown Beech, Moreton Bay Fig, Brush Muttonwood, Tree Heath *Trochocarpa laurina* and Staff Vine *Celastrus subspicata*. Associations with Lewin's Honeyeaters *Meliphaga lewinii* and Topknot Pigeons *Lopholaimus antarcticus* were restricted to October. Catbirds responded aggressively to Pied Currawongs *Strepera graculina*, mostly displacing them with a single pursuit. In one observation, a catbird persistently chased a currawong that had snatched a catbird nestling; however, the outcome was not observed.

Catbirds probing the hollow stubs of Moreton Bay Figs were recorded twice in June 1988 and 1989. It was not known whether this was feeding behaviour. In one observation, the stub was filled with water and the catbird extracted a dead leaf, which it immediately discarded.

Discussion

The fruit component of the diet recorded in this study was lower in species diversity than that of previous studies further north. A gradual reduction in the diversity of fruiting species that serve as food occurs with decreasing latitude: up to 60 species were identified in lowland and upland sites in the Jimna and Conondale Ranges (Innis and McEvoy 1992); 37 in Lamington National Park, Queensland (Church 1997); and 28 species in the Tooloom Range, northern NSW (Donaghey 1981). The present study identified 20 species in the diet, which was expected due to reduced flora diversity (Keith 2004). As with Innis and McEvoy's (1992) study, fewer than 25 % of plant species in the diet of the Green Catbird produced crops with 100 % reliability in any calendar month. Whilst the Sandpaper Fig was consumed many times, figs were not as important in the diet of the Green Catbird when compared to other studies (cf. Donaghey 1981; Innis and McEvoy 1992; Church 1997). This observation held true despite the availability of three other species of fig *Ficus* sp. in the Illawarra region.

In tropical and subtropical forests, there is a correlation between food abundance and breeding seasons in frugivorous birds (Snow and Snow 1964; Crome 1975, 1976), including the Green Catbird (Donaghey 1981; Innis and McEvoy 1992). The breeding season of the species in NSW is from September to February (Higgins *et al.* 2006), during which only six species in the diet fruited reliably: Kangaroo Vine *Cissus antarctica* and Featherwood in September, Brown Beech in November and December, and Moreton Bay Fig in January and February, Pepper Vine *Piper novaehollandiae* in January, and Sandpaper Fig in February. The remainder of the breeding season diet comprises species at the early or late period of crop season (e.g. Black Plum *Diospyros australis*, Sandpaper Fig, Crabapple) or species that fruit sporadically (e.g. Small-leaved Fig *Ficus obliqua*, Brush Muttonwood, White Quandong).

Although stripping vine stems is a known behaviour (Donaghey 1981), Lantana stems are a previously unreported element of the diet in the Green Catbird. Furthermore, at least one third of the fruits found in the diet have not been identified in other studies: Staff Vine, Water Vine *Cissus hypoglauca*, Bolwarra, Sandpaper Fig, Brush Muttonwood, Crabapple and Tree Heath. Foraging associations with honey-eaters, pigeons and other bowerbirds has been documented (Gwynne 1937; Chaffer 1984); however, currawongs in the present study were an apparent predator (at least of nestlings) and were not tolerated by catbirds as they were in other studies (Higgins *et al.* 2006).

Knowledge of the Green Catbird diet in the southern part of its distribution improves the assessment of potential catbird habitat. Robinson (1977) introduced the concept of restoring corridors between wilderness areas in the Illawarra region to facilitate wildlife movements. Connectivity of large and small remnants may be necessary to aid animal and seed dispersal (Price *et al.* 1999; Cramer *et al.* 2007; Gomes *et al.* 2008). This study has identified four tree species that appear to be especially important in the Green Catbird diet in the Illawarra region (Bolwarra, Brown Beech, Featherwood and Sandpaper Fig), as well as a number of feed trees used in the breeding season. Use of these species can be prioritised in future replanting programs to encourage the presence of catbirds.

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One Hundred Years Ago

A SKETCH OF THE KEILOR PLAINS FLORA

BY C.S. SUTTON

Tree Growth

... Before dealing with these groups, reference may be made here to the tree growth of the area. Although ten eucalypts have been noted, only four exist in such numbers that they may be said to belong to the basalt. Of these, the River Red Gum, *E. rostrata*, is undoubtedly predominant, exceeding the others in numbers, distribution, and range. In the eastern part, especially about and between Epping and Woodstock, it forms fine open forests, where trees quite often attain imposing proportions. Perhaps no other of the great genus shows so much individuality as this species, no two trees being quite alike except in that they all bow more or less to the pole in deference to the will of the strong north winds. The varied sweep of their massive, far-outreaching, and often strangely contorted branches, and the sober yet rich colouring of bole and limbs, endows them with a picturesqueness quite redeeming the flat country from its monotony. The Red Gum has almost undisputed possession of all the water-courses, often extending in that way right up on to the open plain. Isolated groups exist near Point Cook and on the Werribee Sewage Farm, and the trees, though small, appear to be of considerable age.

From *The Victorian Naturalist* XXXIII, p. 119, December 1916

A fauna survey in Yarrara Flora and Fauna Reserve and adjacent reserves in north-western Victoria: Fauna Survey Group Contribution No. 27

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Abstract
In 2014, the Fauna Survey Group of the Field Naturalists Club of Victoria undertook a fauna survey in the Yarrara area in far north-western Victoria. Although this was a general survey, of particular interest were the White-browed Treecreeper and Major Mitchell's Cockatoo. The surveys included bird counts along 15 transects previously established for the monitoring of the treecreeper population, as well as three pitfall lines, the use of Elliott traps, harp traps, remote cameras and active searching. Ninety-five vertebrate species were detected, including 10 species listed under the Flora and Fauna Guarantee Act 1988, either as an individual species or part of a listed community. Over 50 detections of White-browed Treecreeper were recorded. There were no detections of Major Mitchell's Cockatoo. Four specimens of Little Pied Bat were captured and released. This species had not previously been recorded in the Victorian Biodiversity Atlas and is listed as endangered in South Australia and vulnerable in New South Wales. The survey helped to document the vertebrate faunal composition of this area and added new species to existing lists for the Yarrara, Mallanbool and Meringur Flora and Fauna Reserves. The results highlight the important role that smaller conservation reserves play in conserving biodiversity in the Mallee landscape. *The Victorian Naturalist* 133 (1), 2016, 10–20)

Keywords: White-browed Treecreeper, Little Pied Bat, Mallee, Beaked Gecko, Yarrara, Semi-arid Woodland

Introduction

The Mallee region of north-west Victoria consists of a network of large national parks (DNRE 1996). Aside from these national parks, there are also a large number of smaller reserves, many of which are relatively poorly known. Often they conserve habitats that are poorly represented in larger reserves (LCC 1987). Small isolated reserves face a range of conservation problems as a result of their isolation in the landscape but they can still fulfil conservation functions (e.g. Saunders *et al.* 1987). The Yarrara and Mallanbool Flora and Fauna Reserves (FFRs) provide good examples of small and isolated reserves with high conservation value. Both have been monitored for the threatened White-browed Treecreeper in the past (Hurley and Cheers 2012).

Ongoing biological monitoring is essential to inform conservation management practices (Lindenmayer *et al.* 2011). A survey in this area, the second collaborative project between Parks Victoria (PV) and the Fauna Survey Group (FSG) of the Field Naturalists Club of Victoria (FNCV), was undertaken to update previous information on the reserves' biota.

The primary aim of the project was to survey existing long-term monitoring transects for presence and numbers of White-browed Treecreeper *Climacteris affinis* (Fig. 1) and other Mallee birds, and to conduct baseline fauna inventory for mammals and reptiles. The surveys of the White-browed Treecreeper transects are linked to an ongoing long-term monitoring project (Hurley and Cheers 2012). A secondary aim was to undertake opportunistic observations for the presence of Major Mitchell's Cockatoo *Lophochroa leadbeateri* and any evidence of its breeding.

Methods

Study sites

The survey took place between 28 September and 3 October 2014, some 80 km west of Red Cliffs (Fig. 2). A base camp was established in Meringur in the grounds of the Community Centre (formerly the Primary School). The main focus of the survey was the Yarrara Flora and Fauna Reserve (34° 24' 8" S, 141° 24' 44" E) which is 2268 ha in size. There were four main survey sites within this reserve: Yarrara North

Fig. 1. White-browed Treecreeper *Climacteris affinis* foraging on dead Belah trunk. Photo by M Antos.

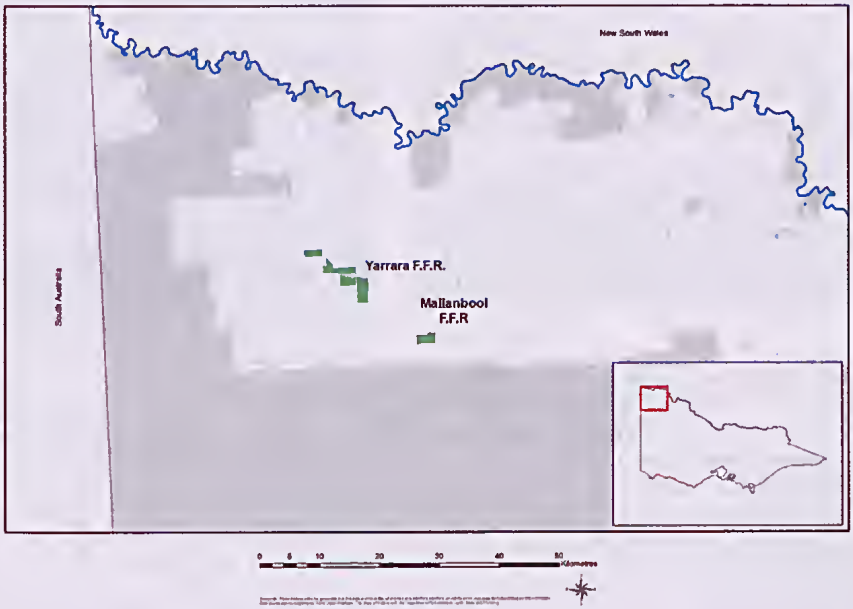

Fig. 2. Location of study sites in north-western Victoria. Shaded areas indicate public land.

(Fox Road, Meringur), Yarrara Central (north of Red Cliffs-Meringur Road), Yarrara South West (south of Red Cliffs–Meringur Road, and west of Yarrara South Road) and Yarrara South East (south of Red Cliffs–Meringur Road, and east of Yarrara South Road). More limited work was carried out in Mallanbool (34° 30' 13" S, 141° 32' 59" E) and Meringur (34° 23' 28" S, 141° 20' 2" E) FFRs which are 517 and 98 ha in size, respectively. Two mallee patches off Meringur South Road were also visited.

The vegetation of Yarrara and Mallanbool FFRs consists predominantly of Semi-arid Parilla Woodland with the dominant tree being Belah *Casuarina pauper*. There are also patches of Woorinen Mallee and Woorinen Sands Mallee, where eucalypts are the dominant tree. Both reserves have been used for timber extraction in the past and as a consequence native pines (*Callitris* spp) have been depleted. Yarrara and Mallanbool FFRs have been subject to detailed botanical assessments which found them to be in very good condition (Kenny *et al.* 2012).

Survey methods

The survey techniques used included remote cameras, bird survey transects with call playback, Elliott traps, pit lines with drift fences, bat traps, spotlighting and incidental observations. The techniques used varied from site to site, with the trapping effort centred on Yarrara FFR. The survey effort by site is summarised in Table 1.

Seventeen cameras were deployed, each for four nights (total of 68 camera-nights). Sixteen cameras were Ltl Acorn Ltl6210M and the other a Scoutguard 550V. Sixteen of the cameras were set for a horizontal shot and placed on star pickets around 1 m from a tea infuser containing bait consisting of peanut butter, oats and golden syrup. These cameras were placed near a bush or log or other cover where it was thought a small mammal might forage. The other camera was placed on a taller star picket to get a vertical shot (i.e. from above).

All cameras were set to video mode for 30 sec and one second between activation. The sensitivity level was set to high and they were set to operate between 6.00 pm and 9.00 am. The PIR (early warning system) was set to 'on' for the Ltl Acorn. This facility is not available in the Scoutguard.

Surveys for White-browed Treecreepers and other mallee birds were conducted along 15 transects. Each transect was 500 m long and 60 m wide (i.e. 30 m either side of the observer). The transects are part of a long-term monitoring program (Hurley and Cheers 2012). Transect separation varies from around 300 to 900 metres. The surveys occurred between dawn and 11.00 am. At the beginning, middle and end of each transect a call of the species was broadcast through a Zoom H1 Handy Recorder, supported by a Moshi Bassburger portable speaker for around 40 sec. Two to three minutes were then spent watching and listening for a response. Call playback ceased if a treecreeper response was detected. All bird species occurring within the transect were counted and recorded. Each transect was surveyed once using this method, and two transects were surveyed twice. There were also additional incidental surveys at three of the sites.

Thirty Elliott traps were deployed at each of three different sites, for three nights, for a total of 270 trap nights. At two sites, they were

Table 1. Fauna survey methods used at the different survey areas.

Area	Remote cameras	Bird Transects	Elliott Traps	Pit Lines	Bat Traps	Spot-lighting	Incidental observations
Yarrara North	X	X				X	X
Yarrara Central	X	X	X	X	X		X
Yarrara South East	X	X	X	X		X	X
Yarrara South West	X	X	X	X	X	X	X
Mallanbool		X			X	X	X
Meringur					X		X
Meringur Rd South							X
Mum and Charlie Roads							X

deployed in three lines of 10 and at the other site in a single line of 30. A mixture of peanut butter, oats and golden syrup was used as bait. Four harp traps were in operation. All four were deployed on three nights and on one night two were deployed, for a total of 14 trap nights. Three lines of pit traps were established, each containing 10 20-litre buckets, 5 m apart. A drift net line connected each row of 10 buckets. Two lines were deployed for four nights and the other for three, for a total of 110 trap nights.

The spotlighting technique and effort varied. Yarrara North and Yarrara Road South surveys were vehicle-based, along perimeter roads. The surveys on Yarrara East Track and in Mallanbool were performed on foot.

Incidental observations were made whenever individual observers or groups were in an area. On occasions this included log turning.

Results

Ninety-five vertebrate species were recorded during the survey: 66 birds, 17 reptiles and 12 mammals. Full species lists, locations and scientific names can be found in Table 2. The survey added 18 new species to the existing Victorian Biodiversity Atlas (VBA) fauna list for Meringur, 13 for Mallanbool and eight for Yarrara.

The range of different survey techniques used ensured that a variety of species from different faunal groups was detected (Table 3). It is interesting to note that five of the seven methods detected species not registered by any other method, the exceptions being Elliott traps and spotlighting. Some incidental observations made at night could reasonably have been classified as spotlighting (most of the Beaked Geckos were found using this method). These results demonstrate the value of multiple survey methods.

Bird surveys

Of the 66 bird species detected nine are either listed under the *Flora and Fauna Guarantee Act (1988)*, or are part of relevant listed communities (Victorian Temperate Woodland Bird Community or Victorian Mallee Bird Community). There were 57 White-browed Treecreeper detections made (Table 4), 25 of these during the formal transect surveys. During the transect surveys the birds were recorded in six of the 15 transects. Incidental observations detected them in the vicinity of a further four transects and at six other sites. Two nesting sites were observed in Yarrara North and Yarrara South West.

No sightings of Major Mitchell's Cockatoos occurred.

Mammal surveys

Small terrestrial mammals were conspicuous by their absence, with only the House Mouse being detected at four sites. Seven species of terrestrial mammal were detected, including four introduced species.

At least five species of bats were recorded, including Gould's Wattled Bat (2 individuals), Inland Forest Bat (1), Lesser Long-eared Bat (7), White-striped Freetail Bat (1) and Little Pied Bat (4) (Fig. 3). There were also 20 individuals of unidentified forest bats (*Vespadelus* spp) caught, but not identified to species level.

The capture of the Little Pied Bat was significant. Three of the four specimens captured were lactating, while the fourth appeared to be pregnant. All were released at point of capture. This appears to be the first time this species has been trapped in Victoria.

Reptile surveys

Seventeen reptile species were recorded, including six species of skink and six species of gecko. Nine individuals of the Beaked Gecko were recorded. This species is listed as Critically Endangered in Victoria. The most numerous species was Boulenger's Skink (13 detections) while snakes were the least detected—only two individuals representing two species (Eastern Brown and Mitchell's Short-tailed Snake) were found (Table 2).

Discussion

The reserves sampled by this survey represent threatened and depleted vegetation communities and are isolated from other areas of vegetation by cleared agricultural land (LCC 1987). Semi-arid Parilla Woodland of the Mallee Region has been depleted by 75% since 1750 to 5900 ha, with only 16% in reserves (Mallee CMA 2008). Kenny *et al.* (2012: 22) stated "This woodland type has high species richness, relative to the other woodland types, across all

Table 2. Species detected during the survey, locations and numbers of individuals. Species in bold denote those listed under the *Flora and Fauna Guarantee Act (1988)*, either as an individual species or part of the relevant listed communities (Victorian Temperate Woodland Bird Community or Victorian Mallee Bird Community). *indicates introduced species. Mall: Mallanbool; Mer: Meringur; MRS: Meringur Rd South; PMR: Purcell-Mums Road; RR: Ruchels Road; YC: Yarrara Central; YN: Yarrara North; YSE: Yarrara South East; YSW: Yarrara South West; T: Total.

Common Name	Mall	Mer	MRS	PMR	RR	YC	YN	YSE	YSW	T
Birds										
Apostlebird										
Struthidea cinerea		10				9				19
Australian Magpie										
Cracticus tibicen	1	1		1		20	5			28
Australian Owlet-nightjar										
Aegotheles cristatus		1								1
Australian Raven										
Corvus coronoides	6	2				7			6	21
Black Kite										
Milvus migrans		1								1
Black-faced Cuckoo-shrike										
Coracina novaehollandiae		1	1			1				3
Black-faced Woodswallow										
Artamus cinereus	1									1
Blue Bonnet										
Northiella haematogaster		2				18	4			24
Blue-winged Parrot										
Neophema chrysostoma		1							2	3
Brown Falcon										
Falco berigora	1									1
Brown Goshawk										
Accipiter fasciatus			1							1
Brown-headed Honeyeater										
Melithreptus brevirostris									1	1
Chestnut-crowned Babbler										
Pomatostomus ruficeps							4			4
Chestnut-rumped Thornbill										
Acanthiza uropygialis	11			5		7	7	9	8	47
Cockatiel										
Nymphicus hollandicus		7								7
Common Bronzewing										
Phaps chalcoptera	2	1				2		2	2	9
Crested Bellbird										
Oreoica gutturalis gutturalis	6					8	1			15
Crested Pigeon										
Ocyphaps lophotes	2	1		2		14	9		2	30
Emu										
Dromaius novaehollandiae	1									1
Galah										
Eolophus roseicapilla	16	1	2			45	11	3	29	107
Gilbert's Whistler										
Pachycephala inornata	3					4				7
Grey Butcherbird										
Cracticus torquatus		1				12	1		2	16
Grey Shrike-thrush										
Colluricincla harmonica	3	1	1			6	3	1	6	21
Hooded Robin										
Melanodryas cucullata cucullata	3					4	2		2	11
Horsfield's Bronze-Cuckoo										
Chrysococcyx basalis	4					2			2	8
House Sparrow*										
Passer domesticus		1								1

Table 2 cont.

Common Name	Mall	Mer	MRS	PMR	RR	YC	YN	YSE	YSW	T
Inland Thornbill										
Acanthiza apicalis			1			11			2	14
Jacky Winter										
Microeca fascinans							2			2
Little Eagle										
Hieraaetus morphnoides		1								1
Magpie-lark										
Grallina cyanoleuca		1				2				3
Mallee Ringneck										
Barnardius zonarius barnardi	2					15			5	22
Masked Lapwing										
Vanellus miles						1				1
Mulga Parrot										
Psephotus varius	1	2				4			3	10
Nankeen Kestrel										
Falco cenchroides	1					2				3
Pacific Barn Owl										
Tyto javanica					1				1	2
Pallid Cuckoo										
Cuculus pallidus	1	1								2
Peregrine Falcon										
Falco peregrinus						1				1
Rainbow Bee-eater										
Merops ornatus	2					2			5	9
Red Wattlebird										
Anthochaera carunculata		1								1
Red-capped Robin										
Petroica goodenovii	3		2			8	3		9	25
Red-rumped Parrot										
Psephotus haematonotus	3	1				1			2	7
Rufous Whistler										
Pachycephala rufiventris	5	1	1			12		2	4	25
Singing Honeyeater										
Lichenostomus virescens	3					12	2		1	18
Southern Whiteface										
Aphelocephala leucopsis	7					46	13		3	69
Spiny-cheeked Honeyeater										
Acanthagenys rufogularis	8					31	3	1	11	54
Splendid Fairy-wren										
Malurus splendens	2			1		6		2	10	21
Spotted Pardalote										
Pardalotus punctatus				1						1
Striated Pardalote										
Pardalotus striatus			3			7			5	15
Tawny Frogmouth										
Podargus strigoides			1				1		1	3
Tree Martin										
Petrochelidon nigricans		1	3							4
Varied Sittella										
Daphoenositta chrysoptera	2					3			5	10
Variegated Fairy-wren										
Malurus lamberti								4	5	9
Wedge-tailed Eagle										
Aquila audax	5									5
Weebill										
Smicrornis brevirostris			5	1		4				10
Welcome Swallow										
Petrochelidon neoxena		2								2
Whistling Kite										
Haliastur sphenurus									1	1

Table 2 cont.

Common Name	Mall	Mer	MRS	PMR	RR	YC	YN	YSE	YSW	T
White-browed Babbler										
Pomatostomus superciliosus	14					23	1		6	44
White-browed Treecreeper										
Climacteris affinis	10	1				14	6	5	21	57
White-eared Honeyeater										
Lichenostomus leucotis						1			1	2
White-plumed Honeyeater										
Lichenostomus penicillatus									1	1
White-winged Chough										
Corcorax melanorhamphos	4	1		4		18			12	39
White-winged Triller										
Lalage sueurii						1				1
Willie Wagtail										
Rhipidura leucophrys	3					2			1	6
Yellow Thornbill										
Acanthiza nana						5	4		7	16
Yellow-rumped Thornbill										
Acanthiza chrysorrhoa	1			2		13				16
Yellow-throated Miner										
Manorina flavigula		1		6						7
Mammals										
European Hare*										
Lepus europeaus			1					1	1	3
European Rabbit*										
Oryctolagus cuniculus			1			2				3
Gould's Wattled Bat										
Chalinolobus gouldii						2				2
House Mouse*										
Mus musculus						3	1	1	3	8
Inland Forest Bat										
Vespadelus baverstocki						1				1
Lesser Long-eared Bat										
Nyctophilus geoffroyi	1					5			1	7
Little Pied Bat										
Chalinolobus picatus						4				4
Red Fox*										
Vulpes vulpes		1								1
Red Kangaroo										
Macropus rufus						13				13
Short-beaked Echidna										
Tachyglossus aculeatus						1			1	2
unidentified Forest Bats										
Genus Vespadelus	1					10			9	20
Western Grey Kangaroo										
Macropus fuliginosus						16			1	17
White-striped Freetail Bat										
Tadarida australis		1								1
Reptiles										
Beaded Gecko										
Lucasium damaeum								1		1
Beaked Gecko										
Rhynchoedura ornata (Note 1)								7	1	8
Bougainville's Skink										
Lerista bougainvillii		1								1
Boulenger's Skink										
Morethia boulengeri	1					9		1	2	13
Bynoe's Gecko										
Heteronotia binoei	1					2				3

Table 2 cont.

Common Name	Mall	Mer	MRS	PMR	RR	YC	YN	YSE	YSW	T
Central Bearded Dragon										
Pogona vitticeps	1					4				5
Eastern Brown Snake										
Pseudonaja textilis		1								1
Eastern Striped Skink										
Ctenotus orientalis								3		3
Grey's Skink										
Menetia greyii								1		1
Mitchell's Short-tailed Snake										
Parasuta nigriceps						1				1
Regal Striped Skink										
Ctenotus regius						3			2	5
Sand Goanna										
Varanus gouldii	1								1	2
Southern Spiny-tailed Gecko										
Strophurus intermedius	3							1		4
Stumpy-tailed Lizard										
Tiliqua rugosa	3					3		1		7
Tree Dtella										
Gehyra versicolor (Note 2)	1							2		3
Tree Skink										
Egernia striolata	1									1
Wood Gecko										
Diplodactylus vittatus						4				4
Grand Total	151	50	23	23	1	487	83	48	206	1072

Note 1: The taxonomy of the *Rhynchocdura* species, previously only *R. ornata* across its range (Cogger 2000), has been expanded in Pepper *et al.* (2011). This work means that *R. ornata* is no longer considered to exist in Victoria, leaving the specimens in the Victorian mallee without an agreed name.
Note 2: *Gehyra versicolor* was formerly *G. variegata* (Hutchinson *et al.* 2014).

Table 3. Number of species detected using the different survey methods.

Faunal Group	Bat Trap	Bird Transect	Camera-remote	Elliott Trap	Incidental observations	Pitfall	Spotlighting
Bats	4				1		
Birds		41			62		1
Mammals			3	1	4	1	1
Reptiles		1	1		12	7	3

Table 4. Survey areas at which the White-browed Treecreeper was recorded and the numbers detected.

Survey areas	Number of transects	Transect survey bird numbers	Incidental survey bird numbers	Total birds
Mallanbool	3	2	8	10
Yarrara North	3	6		6
Yarrara South West	2	13	9	22
Yarrara South East	3		4	4
Yarrara Central	4	4	10	14
Meringur Camp and FFR Reserve			1	1
Grand Total	15	25	32	57

Fig. 3. Little Pied Bat *Chalinolobus picatus*. Photo by M Antos.

vegetation layers (ground, shrub and canopy)'. Semi-arid woodlands dominated by Belah (as is the case in Yarrara and Mallanbool FFRs) were generally found to be in good condition, and on average in better condition than semi-arid woodlands dominated by other species in other reserves. These woodlands are recognised for their high botanical values, with 29 threatened plant species recorded (Kenny *et al.* 2012).

These reserves provide habitat for a number of fauna species whose conservation is cause for concern. Four of the fauna species detected in this survey (White-browed Treecreeper, Crested Bellbird *Oreoica gutturalis gutturalis*, Hooded Robin *Melanodryas cucullata cucullata* and Beaked Gecko *Rhynchoedura ornata*) are listed under the *FFG Act* and a fifth (Little Pied Bat) is considered threatened in South Australia (Schedule 7, *National Parks and Wildlife Act* 1972) and vulnerable in New South Wales (Department of Environment and Heritage, New South Wales 2014).

The White-browed Treecreeper was found to be widespread across the survey areas, with a minimum of 50 individual birds detected. The species was found at, or in the immediate vicinity of 10 of the 15 established monitoring transects. This compares favourably with previous surveys in 2011 when birds were detected on 13 of the 15 transects (Hurley and Cheers 2012). The brief nature of the present survey (only one visit to most transects) suggests that these results are an underestimate. Our results indicate that this species is still secure within the reserves surveyed. The White-browed Treecreeper is reliant on the type of vegetation represented in Yarrara and Mallanbool FFRs (Hurley and Cheers 2012). Yarrara, along with Wyperfeld, is one of the two districts where the White-browed Treecreeper is most prevalent in Victoria (Radford and Bennett 2004).

The presence of eight individuals of the Beaked Gecko is also significant. This is a small and cryptic species and the fact that eight individu-

als were detected during such a brief survey and under marginal conditions (evening temperatures were cool to mild rather than warm) indicates that significant populations could occur in the reserves. The overall gecko richness (six species) was high and there would be few other discrete sites in Victoria where it would be possible to record more species (Wilson and Swan 2013).

Other listed animals, which have been previously detected in the area by other surveys (Victorian Biodiversity Atlas), include Bandy Bandy *Vermicella annulata*, Barking Owl *Ninox connivens connivens*, Black-eared Miner *Manorina melanotis*, Carpet Python *Morelia spilota metcalfei*, Major Mitchell's Cockatoo, Diamond Firetail *Stagonopleura guttata* and Regent Parrot *Polytelis anthopeplus monarchoides*. It is interesting to note that a number of these species, as well as several non-threatened species recorded by our surveys, e.g. Tree Skink, or other surveys, e.g. Coral Snake, are associated commonly with riparian woodlands and habitats (e.g. Emison *et al.* 1987; Swan and Watharow 2005). Yarrara and the surrounding reserves are located at least 20 km from the nearest such habitat associated with the Murray River corridor to the north. The presence of many typically riparian species in this non-riparian reserve may be related to habitat structure. While there is an obvious absence of watercourses, observations during the surveys indicated that the semi-arid woodlands generally had larger trees, more and larger hollows, more soil cracks and larger items of coarse woody debris than adjacent mallee habitat.

Of particular note is the capture and release of the Little Pied Bat. There were no prior records in the Victorian Biodiversity Atlas. This species is generally found further north, although it was suspected as far back as 1995 that specimens would occur in Victoria (Lumsden and Bennett 1995). Our survey not only confirms the presence of this species in Victoria, but suggests that it breeds within the State rather than just passing through as a vagrant. The breeding condition of the animals captured indicates an earlier breeding time of the year than that suggested in Churchill (2008).

While the survey provided a useful snapshot of the fauna present in the reserves, it does have some limitations. For example, many of the bird transects were surveyed only once. Repeat visits would have provided more accurate data. Similarly, equipment such as cameras, Elliot traps, bat traps and pitfall lines were active for relatively short periods of time. Given these limitations, it is likely these results underestimate the conservation values of these reserves.

Management implications

This survey reinforces the conservation significance of smaller and often overlooked reserves in the landscape context. In the Mallee region there are a number of very large and well-known iconic national parks which tend to figure more prominently in conservation planning, research effort and resource allocation. However, for a range of reasons, smaller reserves can often support habitat types which are poorly represented in larger reserves (LCC 1987). Often they occur on more fertile soils where much of the surrounding land has been cleared for agriculture. The fauna information obtained by this survey will provide local managers with better knowledge of the natural assets within the reserves which can be used to help with planning further management activities and State of the Parks reporting.

All the reserves examined by this survey are isolated from other vegetation remnants by cropland, therefore fragmentation will always be a long-term conservation issue. This is especially the case for species with poor dispersal capabilities such as reptiles. Other species of treecreeper have been shown to be particularly sensitive to habitat fragmentation (Walters *et al.* 1999) and this is clearly a key issue facing the persistence of the White-browed Treecreeper in these reserves (Radford and Bennett 2006). Faunal relaxation and extinction debt, where species survive the initial habitat fragmentation only to gradually perish in isolated remnants many years later, may be a possibility in the case of these reserves. Ongoing monitoring will be required to provide an early warning of such an eventuality.

Within the reserves, the attrition of hollow-bearing trees will be an ongoing future conservation issue given that the treecreeper and a range of other threatened species are obligate hollow nesters. It is important to ensure that

new cohorts of seedlings can survive to adulthood to maintain a continuum of maturing trees that can develop hollows in future (Kenny *et al.* 2012). In some cases, this may necessitate the management of native and exotic herbivores to allow plants to survive the seedling stage. The dominant tree species of semi-arid woodlands are sensitive to fire (Kenny *et al.* 2012) and management needs to focus on protecting remaining remnants from wildfires. Given the small size of reserves, tree mortality could have negative impacts on hollow-dependent fauna.

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African Carder bee, *Afranthidium (Immanthidium) repetitum* (Hymenoptera: Megachilidae): a new exotic species for Victoria

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Abstract
In December 2014, the African Carder bee *Afranthidium (Immanthidium) repetitum* was collected from a garden in the Melbourne suburb of Kew. This is the first record of this exotic species for Victoria. First introduced to Australia in south-east Queensland in 2000, the species has undergone a massive range expansion since this time. The introduction of this bee may result in the proliferation and spread of environmental weeds in Victoria, and ongoing monitoring is required to determine the extent of its distribution. Behavioural observations are required to determine the potential impacts it may have on native bee and weed populations. (*The Victorian Naturalist* 133 (1), 2016, 21–24)

Keywords: hymenoptera, introduced species, range extension

Introduction

The African Carder bee *Afranthidium (Immanthidium) repetitum* (Schultz, 1906) is a bee of the Megachilidae family and native to South Africa. The bee has a body length of approximately 6–8 mm, with distinctive transverse coloured bands on its abdomen. Females (Fig. 1) have thin white bands and males (Fig. 2) have thicker, yellow-coloured bands. These bands can be used to distinguish it from all native Australian megachilid bees. Colour bands on Australian bees are due to coloured hairs, whereas the African Carder bee has a pigmented exoskeleton. The face, sides of the thorax and bottom half of the legs are covered with white hairs (Walker 2014). The nests of African Carder bees are unlike those of any native Australian bees and are one of the easiest ways to identify their presence (Fig. 3). They are constructed out of harvested hair-like plant fibres, which differ from the cut leaves or plant resin used by Australian Megachildae species. Female bees scrape fibres from leaves and stems with their mandibles and roll them into balls resembling cotton wool (BowerBird 2014). Although members of this species do not form a hive, they are communal, with large masses of brood cells commonly found in the one place (Michener 2007).

The African Carder bee was first recorded in Australia in Brisbane in 2000 (Burwell and King 2000). It is likely the species was accidentally transported to Australia in cargo (Gess and Gess 2007). By 2008, it had extended its range south and was established in Sydney (Atlas of Living Australia 2008). Researchers surveying urban bee diversity found that this species is now one of the most common bees in community gardens across Sydney (T Latty pers. comm, 2015). More sightings were reported in Rockhampton, Queensland in 2014 and Clermont, Queensland in 2015 and in Albury, NSW in 2014) on the Citizen Science website BowerBird (2015), extending its known distribution by hundreds of kilometres north and south of its original Brisbane location and subsequent Sydney 'invasion'.

In December 2014, while surveying bee populations with pan traps in residential gardens and remnant parklands in Melbourne's eastern suburbs, we collected a male Carder bee specimen, the first official record of *Afranthidium (Immanthidium) repetitum* in Victoria. In March 2015, we collected the first female specimen while sweep-netting, and other Melbourne sightings have since been reported on Bowerbird in Camberwell and Vermont, both in 2015. We have been undertaking sampling of bee communities in Melbourne's urban green spaces since early 2012 and have not previously recorded any sightings, suggesting that the Carder bee has only recently arrived as far south as Melbourne. The species has undergone a massive range expansion over a large latitudinal distance in only a short period of

Fig. 1. Female African Carder bee *Afranthidium (Immanthidium) repetitum*. Photo by Ken Walker.

Fig. 2. Male African Carder bee *Afranthidium (Immanthidium) repetitum*. Photo by Ken Walker.

Fig. 3. The material used to construct nest cells resembles cotton wool and is unlike any nests of native Australian bees. Photo by Ken Walker.

time, which suggests it is capable of persisting in many different climates (Fig. 4). Due to the behaviour of this species nesting in confined human constructions such as wooden boxes and sliding window frames (see Queensland Museum 2010 for images and information), we believe the rapid and extensive spread of this bee across three states in less than 15 years has been aided by humans.

There are numerous documented introductions of bees to countries far beyond their native range (Goulson 2003). Introductions of exotic bee species to Australia have been both deliberate for the pollination services they provide and accidental through quarantine breaches. In Australia, the European Honeybee *Apis mellifera* was introduced in 1822 primarily to provide a source of wax to make candles but also to provide honey and pollination for non-native agricultural crops (Pyke 1999). This species is now widespread across Australia. The Leaf-cutting bee *Megachilidae rotunda* was introduced into South Australia in the 1980s to improve pollination of alfalfa (Batley and Hogendoorn 2009). Bumblebees *Bombus terrestris* arrived in Tasmania in 1992 (Batley and Hogendoorn 2009), and an exotic *Halictus* species has been documented in NSW (Gollan *et al.* 2008). Exotic species cause few problems in their native range; however, when released into a new habitat and country that lacks their native population regulators (i.e. predators and parasites), it is difficult to assess their potential impact accurately. Two potential problems that could be caused by an exotic bee species are the impact on Australia's unique bee fauna of over 1660 endemic species, and a proliferation of introduced weed species already here in Australia if the exotic bee is an effective pollinator of these weeds.

Discussion

The ongoing effects of exotic bees are variable, and in many cases are largely unknown (Batley and Hogendoorn 2009). It is possible that exotic bees may adversely impact on native bees by transmitting foreign pathogens to native populations (Goulson 2003) or by displacing

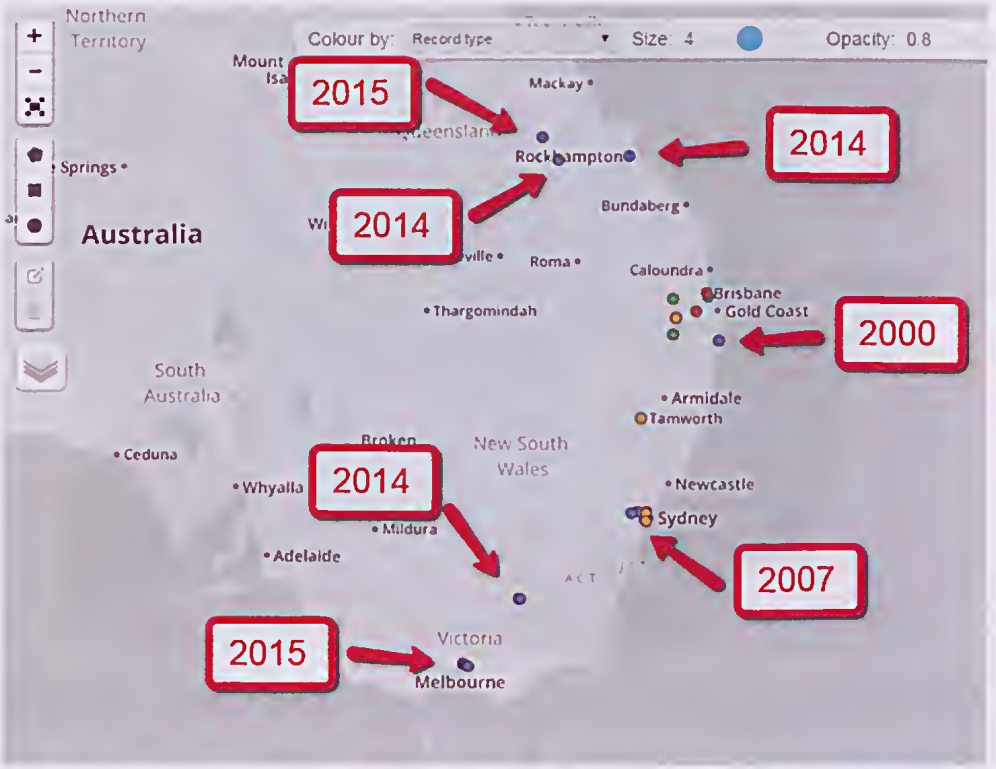

Fig. 4. Current known distribution of the African Carder Bee (Source: Atlas of Living Australia. Blue dots indicate records from BowerBird; other coloured dots are primarily Queensland and Australian Museum records).

them through competition for limited floral and nesting resources (Hingston and McQuillan 1999). Some exotic bee species also exhibit aggressive flower-patch defending behaviour towards other flower-visiting insects, as is the case with males of the European Wool-Carder bee *Anthidium manicatum*, which has become established in many countries far beyond its native range, most recently in New Zealand (Donovan 2007). Of particular concern with the introduction of an exotic bee species is the potential increased pollination and spread of introduced weeds (Goulson 2003). Many exotic weed species have established in Australia but have not yet become widespread. Known as 'sleeper weeds', these naturalised plant species have remained in low numbers as they have been limited by various factors, such as the lack of a suitable pollinator (Groves 1999). In particular, invasive weeds such as thistles and Solanaceae plants require 'buzz' pollination to be effectively pollinated (De Luca and Vallejo-Marín 2013). Australia's only buzz pollinators are the Blue banded bees (*Amegilla* spp.) and Carpenter bees (*Xylocopa* spp.) (Hogendoorn *et al.* 2007). Carpenter bees, with only eight Australian species and *Amegilla*, with 59 Australian species, are solitary nesting bees. This nesting habit means these bees never build into large population numbers and therefore deliver only limited buzz pollination services. The buzz pollinating *B. terrestris* now established in Tasmania has been shown to increase seed set in both *Lupinus arboreus*, classified as a major weed species in New Zealand where the Bumblebee was introduced in the late 19th century (Stout *et al.* 2002), and *Lotus uliginosus* (Hergstrom *et al.* 2002). While the African Carder bee does not buzz pollinate, the spread of any exotic pollinator needs to be closely monitored. Un-

like most native Australian bees, which possess short tongues (Armstrong 1979), their longer tongues enable them to feed on and potentially pollinate a range of flowers with both long and shallow nectar tubes. At present, little is known about the foraging preferences and floral resource use of the African Carder bee in Australia, although records indicate a preference for plants from the Lamiaceae or mint family, which includes genera such as *Prostanthera* and *Westringia*, in their native environment (Gess and Gess 2007). As the African Carder bee spreads to more parts of Australia across a large geographic and climatic range, it remains to be seen whether this bee will cause previously contained weed species to increase in abundance and extent, and / or have an effect on native bees.

Future research

Continued monitoring of the African Carder bee's distribution is needed to determine how widespread the species actually is across the continent. Behavioural observations and dedicated experiments are also required to determine what its potential impacts may be on native bee populations and introduced weeds. So far, it has largely been citizen scientists who have recorded sightings of this exotic species and they will continue to play a crucial role in documenting any further spread of the Carder bee population, and potentially important ecological data such as floral resource use and interactions with native bees. Suspected sightings can be confirmed by uploading images and locations to the BowerBird African Carder Bee monitoring project. A BowerBird User Guide is available at: http://researchdata.museum.vic.gov.au/images/How_to_use_BowerBird.pdf.

Acknowledgements

We thank Tanya Latty for her population studies of urban bee communities in Sydney and her dissemination of information about the African Carder bee.

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2015 Australian Natural History Medallion

Margaret MacDonald OAM

The 2015 Australian Natural History Medallion has been awarded to Margaret MacDonald OAM for her contribution to conservation and the environment of the East Otway region

Margaret has been involved as the leader and major researcher in a number of significant projects in the Anglesea and Aireys Inlet district, including:

- surveying to discover, record and photograph orchid populations;
- discovering, recording and photographing indigenous flora species for ANGAIR;
- leading annual survey of *Caladenia maritima* to record the density and extent of the species population;
- working with staff of the National Herbarium (in particular, Neil Anderton) to collect material for cultivation, and endeavouring to ascertain pollinating agent;
- conducting annual survey of Spiral Sun Orchids *Thelymitra matthewsii* in conjunction with DELWP to ascertain growth of populations and the effect of fire on the species;
- leading projects to record the occurrence of rare and threatened flora species in the area, particularly: *Grevillea infecunda; Olearia pannosa;* and *Leiocarpa gatesii.*

Margaret has also actively contributed to other researchers' projects in the Otways region. For example, her detailed local knowledge is of assistance to Dr Michael Duncan (Department of Environment, Land, Water and Planning) in annual monitoring of the *Thelymitra matthewsii* population at Gum Flat; she provides information for the Recovery Plan for this species. Other research projects in which Margaret has been involved include that of Dr Trevor Edwards (Latrobe University) who has PhD students working on pollination of orchids; she provided in-field assistance to Enid Mayfield with the author's research toward *Flora of the Otway Plain & Ranges* , Volumes 1 (2006) and 2 (2013); she assisted orchid experts Jeff Jeanes and Gary Backhouse in their research toward *Wild Orchids of Victoria* (2006), with local knowledge of the Anglesea district. Margaret's generous assistance is acknowledged in each of these publications.

It was during the field work with Jeanes and Backhouse that Margaret and her sister, Kath Morgan, rediscovered *Thelymitra* x merraniæ at Moggs Creek in 1992. This species had been absent over a very long period and was considered to be extinct. It is now listed under the *Flora and Fauna Guarantee Act*, and Margaret continues to conduct annual surveys for the species. Margaret also discovered *Caladenia maritima* in 1998, a new species of terrestrial orchid on the Anglesea Heathlands that is endemic to the Anglesea district.

In addition to her work in studies of local flora, Margaret has participated over many years in ongoing regular mammal surveys with the Friends of Eastern Otways (FEO) using a range of strategies to increase knowledge of mammal populations in the district. This has included documenting the presence of Yellow-bellied Gliders for the first time in the forest area at Moggs Creek. She has worked with Dr Graeme Coulson and zoology students from The University of Melbourne) on their research of the Eastern Grey Kangaroo population based at Anglesea Golf Course; with Dr Grainne Maguire, Birdlife Australia, in monitoring numbers, and protecting Hooded Plover populations on the Surf Coast; and she participates in annual koala surveys with FEO Inc. at Grey River.

Margaret is a regular leader of field excursions for ANGAIR & FEO, as well as a range of other local groups. She has made many public presentations—to meetings, on radio and television—on the subject of indigenous flora and fauna in the eastern Otway region. She is the author or editor of a range of publications based on this fieldwork, including six books, and a number of reports and brochures. She is well known also for her field photography, many examples of which appear as illustrations in her books.

The 2015 Medallionist has an enviable publication record. She is the author or editor of a number of significant works on aspects of the natural history of the Anglesea/ Otway region. These books include *Environmental Weeds: invaders of our Surf Coast* (originally published in 1998; 2nd edition, 2002; reprinted with additional information, 2007); *Surf Coast Shire Environmental Directory* (2000); and *Orchids of the Anglesea District* (originally published in 1999; 2nd edition , 2004; 3rd edition, 2009) and *Flowers of Anglesea and Aireys Inlet* (2009). These books are profusely illustrated, some exclusively, with Margaret's own photographs.

Margaret was awarded a Medal of the Order of Australia in 2011 for service to conservation and the environment of the East Otway region. She was nominated for the Australian Natural History Medallion by the Anglesea, Aireys Inlet Society for the Protection of Flora and Fauna Inc (ANGAIR), of which she is an honorary life member. The Medallion was presented to her by Dr Bill Birch AM, President of the Royal Society of Victoria, on Monday, 9 November 2015.

Gary Presland
40 William Street
Box Hill, Victoria 3128

Margaret MacDonald OAM with her Australian Natural History Medallion and presenter Dr Bill Birch AM, President of the Royal Society of Victoria, 9 November, 2015. Photo by Ros Gibson.

Australian Natural History Medallion Trust Fund

Since February 2015 donations to the Trust Fund have been gratefully received from the following:

	$		$
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Julia Davis	10	Kaye Proudley	5
Daryl Akers	10	John Poppins	20
Brendan Murphy	50	A R Flack	5
Helen Handreck	21	Peter Fagg	20
Alan Reid	21	FNCV	200
Vict'n Ornithological Research Group	25		

If you would like to contribute to this fund, which supports the Australian Natural History Medallion, donations should be sent to: The Treasurer, Field Naturalists Club of Victoria, PO Box 13, Blackburn, Victoria 3130. Cheques should be made payable to the 'Australian Natural History Medallion Trust Fund'.

The medallion is awarded annually to a person who is considered to have made the most significant contribution to the understanding of Australian natural history in the last ten years.

Gary Presland
Secretary, ANHM Committee

Ninety-nine Years Ago

ON THE GROWTH OF *EUCALYPTUS VIMINALIS*, F. v. M.
BY P. R. H. ST. JOHN

The following notes on the rate of growth of a young Manna Gum, *Eucalyptus viminalis*, Labill., together with records of the first shedding of the bark and the development of the flower buds from their first appearance to maturity, seem to be of sufficient importance to be placed on record.

During the Christmas and New Year holidays of 1910-11, I found at Cunninghame some dwarf trees of *Eucalyptus viminalis*. Fruiting specimens were secured, and in due course placed in my herbarium. In January, 1912, when looking through my collection, it occurred to me to sow some of the seeds that had fallen out of the seed-vessels. This was done, and one of the seedlings raised was planted in my garden at South Yarra in August, 1912, the young plant being then ten inches high. Although not five years old till January, 1917, it is now 25 feet in height, and nine inches in diameter at one foot above the ground. The first signs of flower buds were noted on 9th November, 1915. These are now fully grown, and a number of them burst into bloom a fortnight ago (Saturday, 25th November, 1916). The next lot of young buds were noted earlier in the month (7th November).

It is also worthy of note that the tree is now shedding its bark for the first time. So far as I can recollect, this is the first occasion on which the age of a eucalypt, when the bark is first shed, has been recorded.

The tree, it may be added, has not received any special treatment or care, and is growing in a sandy formation similar to the trees at Cunninghame from which the seed was originally obtained.

I trust the recording of these facts will induce other members, especially those who live in country districts, to make similar observations regarding this and other species of the genus, and so enable comparisons to be made which may lead to important results.

[This tree was in full bloom on 25th January, 1917. – ED. Vict. Nat.]

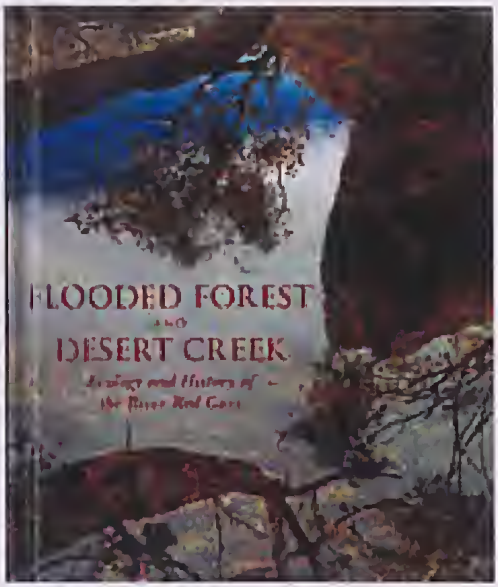
From *The Victorian Naturalist* **XXXIII**, p. 155, February 8, 1917

Flooded forest and desert creek: ecology and history of the River Red Gum

by Matthew J Colloff

Publisher: *CSIRO Publishing, Collingwood, Victoria, 2014. 325 pages, hardcover. ISBN 9780643109193. RRP $69.95*

This book is fascinating. It is about the historical ecology of the River Red Gum Eucalyptus camaldulensis, and thus considers the effects of historical events on this iconic species and across its broader landscape. So, if you are not an ecologist, buy the book anyway! It is well worth it. Historical ecology is concerned with interactions that drive variations and exceptions; interwoven with the wealth of information on the River Red Gum itself is the human perspective on these trees and how this has changed with time. The book considers: the culture of Aboriginal Australians and their lore; the role of the species in the tension between economy, society and environment since European settlement; poetry; art; politics; our national consciousness; and much, much, more.



The Introduction sets the scene for the book—what is covered, how and why—and includes a brief explanation of the difference between environmental history and historical ecology. If you do not think the book could be of interest to you or another for whom the book would be a gift, the final paragraph of the Introduction may convince you. It beautifully contextualises the importance of the River Red Gum to Australia and Australians:

> The river red gum, this glorious and extraordinary tree, is of far wider importance than just to environmental biologists and natural resource managers concerned with its adaptations to extremes of drought and flood. It connects across time, place and people, land and water, desert and forest. It is the common subject of interest between commerce and conservation, resident of bush and city, logger and conservationist, Aboriginal Australian, European settler and recent arrival, politician and constituent, between the pioneering, land-clearing past and the sustainability-driven present. It is the quintessential Australian - tough, adaptable, enduring and slightly unkempt. This, then, is its story and the record of its connections. (p. xvii).

Following the Introduction, the book is divided into three parts: Part 1, 'The unfolding forest'; Part 2, 'Forces of change'; Part 3, 'From exploitation to conservation and multiple values'. Within Part 1, there are four chapters. Chapter 1: 'Floodplain and river' examines the ancient floodplains, climate and landscape changes and the first people, and the forests and woodlands. Chapter 2: 'Names and relationships' discusses natural variation of the River Red Gum, the seven subspecies and evolution and biogeography. Chapter 3: 'Life history' gives an account of the reproduction and establishment of the species and the relationship between water and growth. Do you know why River Red Gums have the nickname 'widow-maker'? Many of us would relate this to the habit of eucalypts

dropping branches, and this is the case. But why do they drop their branches? Apparently it is an attempt to reduce water stress. During water-stress, River Red Gums, and many other eucalypts, reduce their water requirements by shedding leaves. During severe water stress, River Red Gums also shed whole branches, especially their lower limbs, and so have become infamous for being dangerous to camp under. The dropping of limbs appears to be associated with a decrease in the cross-sectional area of sapwood, which conducts the water up the stem and to the leaves. I find this a fascinating subject and, therefore, would have liked more discussion of it. however, I was sufficiently motivated to research the topic further and consider this a commendation to the author. Chapter Chapter 4: 'Ecosystem functions' considers the River Red Gums as productive refugia in a dry landscape, as an ecosystem engineer and nature's supermarket and boarding house, and finishes with a section on its role as a facilitator and self-organiser. Within the following quote one can see how artfully Colloff interweaves information e.g. aspects of biology, chemistry, zoology, ecology and anthropology, to cater for the varied interests of readers:

> During dry periods many arid dwelling animals survive by satisfying most of their water requirements via their diet. For animals feeding on plant tissues, the water contained in the leaves, stems, flowers and fruit serves most of their basic needs. Herein lies a small miracle of biological synergy. Many of the animals that feed and gain their water from the river red gum are insects. And insects are particularly adept at digesting plant tissues and synthesising the products of digestion into fats and oils, stored in an organ called the lipid body. Many insect larvae – the caterpillars and grubs – are almost exclusively leaf-feeders and up to half their total bodyweight may consist of stored fat. The larvae of some of the larger moth species are a high-energy, nutritious food, much prized as a delicacy by Aboriginal people. The Arrernte use grass stems to hook out ingwenenge river red gum grubs from holes in the tree trunks. When 1 g of fat is digested and broken down in the presence of oxygen it makes 1.1 g of oxidation water, compared with only 0.6 g of water from 1 g of starch and 0.4-0.5 g of water from 1 g of protein. Metabolic water sources, such as fat-rich insect larvae, are an important means by which certain desert birds, reptiles and mammals meet some of their daily water requirements, making them less reliant on sources of drinking water.' (pp. 76–79).

Part 2 also includes four chapters: 'Fire'; 'Grazing'; 'Timber harvesting and floods'; and 'Droughts and river regulation'. These relate to the factors that have driven changes in River Red Gum landscapes. Colloff states 'There is nothing more controversial in environmental history than the subject of fire.' (p. 101). He states that the role of fire with respect to management of River Red Gum forests is unclear and should be framed in the context of floodplain landscapes and vegetation. He covers this in detail and, because of this, he suggests some readers might prefer to skip this section; however, my recommendation is that people read it. The chapter on fire is a review of much literature with highly pertinent discussion of significant issues. The chapter is well researched and written, as is the rest of the book. As well, it includes a myriad of gold informational nuggets concerning Aboriginal and European Australian history and culture in a way that maintains the reader's interest; the chapter is a pleasure to read. The chapter on grazing discusses historical impacts; post-settlement impacts; and grazing and conservation. I was particularly interested in the comment and accompanying photo of the damage by rabbits to a River Red Gum sapling (Fig. 6.6, p. 139). I did not realise that rabbits could climb young trees, and when I first turned the page and saw the figure and caption I thought 'big bunny'. These snippets of information have kept me just as fascinated with the book as the scientific arguments have. The chapter on timber harvesting is well researched, illustrated and constructed. It covers a number of issues: 'the timber rush', 'harvesting and regeneration'; and 'uncovering the forests of the past'. I found the diagram and graph depicted in Fig. 7.13 (p.164), on the effect we have had on River Red Gum distribution, particularly telling. In 2010, just over 60% of trees within the study plot (1 ha) had a diameter class of <25 cm, while the same area in the 1860s had about the same proportion of trees in much larger diameter classes (≈30% in the 75-100 cm diameter class and ≈32% in the >100 cm class). This means our River Red Gum landscapes of yesteryear were very different in

structure and appearance from those of today. Needless to say, these would have a significant effect on the ecosystem functions of these trees. Having had the privilege of seeing some massive trees within my lifetime, my first instinct was to lament the loss of old growth landscapes, but I was heartened by the positive outlook expressed by Colloff:

> We know trees have different growth rates and water requirements according to their age. If we can predict the changes in density of trees in future forests and have a rough idea of how much water trees of different age classes require to maintain growth and reproduction, then we can assess the environmental water requirements to maintain a healthy, dynamic river red gum forest. Knowing the water requirements of forests with different age structures is likely to contribute to a more adaptive and nuanced approach to the management of valuable environmental water allocations under the framework of water reform being implemented in the Murray-Darling Basin. (p. 164).

Chapter 8 begins with a poem by Banjo Paterson. Insertions of poetry such as this, as well as historical artwork and commentary throughout the book, adds yet another level of interest. This chapter investigates records of drought and flood, how nature affects progress, water management and associated ecological change and the future of environmental flows.

Part 3 considers 'River Red Gum consciousness'; 'Conservation and multiple values'; and 'The future of the river red gum'. Considering that Australia is a country with drought as a significant part of its climatic rhythm, it is understandable that the River Red Gum has become part of the consciousness of its inhabitants. Colloff states: 'It is the combination of tree and water that is so compelling, so essential. Where there is water there is life. A tree that stands for water and life will surely be loved and revered.' (p. 197). It would seem so, and I hope so. Colloff discusses Aboriginal stories and symbolism, landscape art, environmental awareness and more. You might be surprised to discover that The Australian Woman's Weekly has played a role in the development of environmental awareness, or that the River Red Gum has starred in a considerable number of documentaries, films, and writings. The last section of the book is one of hope and details the importance of the River Red Gum trees to people; it includes various quotes to demonstrate the intensity of feeling people have for this iconic species.

As I said at the beginning, this book is fascinating and a pleasure to read. Colloff provides invaluable insights and interesting perspectives, and demonstrates the close connection he has with the trees, their landscape and their history. I am sure this book will become a highly desired reference, not only because of its scientific worth, but also because it delves into so many aspects of our history and lives. At $69.95, it is a bargain!

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One Hundred Years Ago

THE SEPTEMBER FLOODS.—The heavy rainfall of September, 1916, in Melbourne amounting to the abnormal quantity of 793 points, will be long remembered by the floods which it caused, not only in the Yarra, but in many other streams throughout the State. In connection with natural history and the floods, the question arises what effect will they have on the fauna during the ensuing twelve months. Doubtless many snakes have been washed out of their winter retreats and drowned. Their loss is not regretted by most people, nor yet that of the rabbits which also lost their lives by drowning. But the question arises to the pond-life man, will he be able to find his favourite species in its accustomed haunts? It will be interesting to have reports from workers during the coming summer as to the distribution and prevalence of species in the various localities they are acquainted with, as compared with normal seasons. It seems hardly likely that after a favourite lagoon has been covered by twenty feet of water, for nearly a week in many cases, that the pond-life there will be as numerous or as varied as it was before. The question is one that might well be systematically investigated during the next few months.

From *The Victorian Naturalist*, XXXIII, p. 88, October 5, 1916